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Connecting the cytotoxic and genotoxic effects of multi-walled carbon nanotubes to their physicochemical properties

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Statement of the Problem: The manufactured nanomaterials (NMs) have specific physicochemical properties that confer unique characteristics beneficial for biomedical and industrial applications, but that can also determine nano-bio interactions leading to toxic potential. However, the investigation of the genotoxic properties of NMs has been mostly inconclusive, since divergent results have been reported in the literature. To contribute for the safety assessment of NMs, it is important to try to ascertain the NM characteristic that determines the adverse effects, allowing the synthesis of innovative NMs devoid of toxicity.

Objective & Methodology: The present work explores the correlation between physicochemical properties of benchmark NMs (multi-walled carbon nanotubes, MWCNTs) and their cytotoxic and genotoxic effects in human respiratory cells (A549 and Beas-2B), through the MTT, clonogenic, micronucleus and comet assays.

Conclusion & Significance: After 8-days exposure, the clonogenic assay showed cytotoxic effects in A549 cells for all the tested MWCNTs. Correlation analysis suggested an association between the MWCNT size in cell culture medium and cytotoxicity. No induction of DNA damage was observed after any MWCNT exposure in any cell line by the comet assay, while the micronucleus assay revealed that both NM-401 and NM-402 were genotoxic in A549 cells. NM-401 and NM-402 are the two longest MWCNTs analyzed in this work, suggesting that length may be determinant for genotoxicity. No induction of micronuclei was observed in the Beas-2B cell line. The different effects in both cell lines are explained in view of the size-distribution of MWCNTs in the cell culture medium, rather than cell's specificities. Therefore, tackling NMs safety issues is a complex and challenging issue. It is mandatory that toxicologists adequately characterize both the primary and secondary physicochemical properties of the test nanomaterials and use several endpoints to allow a correct interpretation of data.

Biography

Henriqueta Louro has worked in the analysis of potential mutagenic effects of chemical or physical agents *in vitro* and *in vivo*. She is also involved in human biomonitoring studies, namely to investigate the biological effects of chemical exposures (HBM4EU), environmental tobacco smoke and also in populations exposed to background radiation originated from natural sources or resulting from uranium mining debris. Her research work is focused on the impact of xenobiotics from the environmental and occupational settings on the human genome. Her recent work involves nanotoxicology, with participation in European projects (Nanogenotox and NanoReg) as well as in national projects.

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